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Results of the Primary Ecological Test of Nurseries Organized on the Basis of International Winter Wheat Improvement Program Performed in Absheron

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The information on the leading International research centers of wheat such as International Maize and Wheat Improvement Center (CIMMYT), International Center for Agricultural Research In the Dry Areas (ICARDA), and International Winter Wheat Improvement Program (IWWIP), the goals and results of the scientific collaboration of the Research Institute of Crop Husbandry with these centers, and the results of the primary ecological tests performed in the International nurseries (in 2015 and 2016) have been presented in the paper.

Keywords: *Wheat, variety, selection, introduction, international nurseries, earing, grain yield, yellow rust, brown rust, powdery mildew*

INTRODUCTION

Currently, due to widespread of natural anomalies such as various climate changes, drought, flood, degradation and desertification of lands, wheat having a strategical importance, play a crucial role in food security of every country, including Azerbaijan. Wheat is distinguished by its wide cultivation spectrum and adaptive properties in the ecological point of view (Briggle, Curtis, 1987). Wheat can be cultivated under a broad range of soil and climatic conditions except the tropics. According to the geographical conditions 2 main “wheat zones” exist in the world: between 30°C and 60°C of the northern latitude, and between 27°C and 40°C of the southern latitude (Nuttonson, 1955). Mean annual precipitation in the wheat cultivated dry areas varies between 375 mm and 875 mm. Wheat can be cultivated even in the territories with annual precipitation from 250 mm to 1750 mm (Leonard, Martin, 1963). Adverse environmental factors - frost, heat, humidity, drought have a serious impact on wheat productivity and quality. Therefore, along with the developing varieties tolerant against harmful biotic and abiotic factors, it is also very important to improve wheat cultivation in non-irrigated territories. International research centers of wheat such as International Maize and Wheat Improvement Center (CIMMYT), International Center for Agricultural Research In the Dry Areas (ICARDA) were created to solve such issues.

CIMMYT being a leading international research center that possesses the largest genbank of wheat, is committed to providing global food security, reducing poverty, improving wheat and maize productivity. ICARDA performing the same mission, manages the research on the cultivation of wheat, barley and leguminous plants in non-tropical, dry territories. Various programs were developed for the Central Asia, West Asia and North Africa (CWANA) by ICARDA and CIMMYT.

IWWIP was established in the mid-1980s jointly by Ministry of Food and Agriculture of Turkey, CIMMYT and ICARDA as an International Program to improve embryo plasma of winter bread wheat. The major goal of the program is to improve the genetic material of facultative and winter wheat for Central and Western Asia regions. IWWIP focuses on the exchange of wheat genetic materials related to the world breeding programs, creation of genetic materials for irrigated and dryland areas, conducting international tests of genetic materials belonging to national selection programs of the regional countries.

The Research Institute of Crop Husbandry created direct relationships with CIMMYT and ICARDA in 1996. Since then the institute has implemented the introduction and exchange of genetic materials for wheat breeding (Abdullayev, Musayev, Talai, 2008, Aliyev et al., 2013, Talai, 2005, Talai, 2013). The main purpose of this scientific collaboration is the choice of hybrid lines suitable to Azerbaijan regions with contrasting soil and climatic conditions and their use in breeding. The cultivation of the developed varieties have been organized in farms of the irrigated and dryland regions of Azerbaijan (Talai J.M. et al., 2017). As a result of the joint investigations performed with the International Centers for many years, 7 bread wheat

varieties (Azamatli 95, Nurlu 99, Gobustan, Tale 38, Gyzyl Bughda, Guneshli, Layagatli 80) have been developed, regionalized, included in the State Registry of the Selection Achievements and patented (Mahmudov, Talai, Morgunov A, 2002). The cultivation area of these varieties in Azerbaijan covers more than 180 thousand ha.

The aim of the research: The implementation of the primary ecological tests of durum and bread varieties of various purpose introduced from the international selection centers- CIMMYT and ICARDA, evaluation of these varieties according to their life conditions, morphological traits, productivity, resistance to diseases and the choice of samples for the future research and hybridization.

MATERIALS AND METHODS

Field experiments were performed in the experimental field of the Research Institute of Crop Husbandry situated on the Absheron peninsula. The objects of the study were wheat genotypes introduced from the International Selection Centers - CIMMYT and ICARDA in accordance with IWWIP. The phenological observations were performed from germination till the complete maturation phase according to Kuperman (Dospekhov, 1985, Kuperman, 1984). Exposure to diseases was conducted based on the methods of the International Selection Centers (Rust scoring guide, 1986). The field experiments were carried out according to the scheme recommended by the International Organization ICARDA (Instructions rrigated twice during the vegetation period and ammonium nitrate fertilizer was applied in Spring.

RESULTS AND DISCUSSION

Life conditions, overwintering, earing period (number of days from the 1st of January to earing) of the studied varieties from the wheat genfund were determined, the heights of the plants were measured, and resistance to lodging and diseases was examined. Evaluation of the infection with yellow rust, brown rust and powdery mildew was performed according to the scales, meeting the international standards. Productivity indices of the planted samples were determined. Samples recommended for hybridization were chosen to develop new varieties suitable to various agro-ecological conditions of Azerbaijan.

Based on the results of the ecological tests, we could conclude that not the all studied materials were suitable to the local soil and climatic conditions. Samples chosen from the nurseries organized by the joint program of Turkey's government, CIMMYT and ICARDA- Facultative and Winter Wheat Observation and Yield Trial (FAWWON, IWWYT, WWON-IR, WWON-SA), Winter Wheat East European Regional Yield Trial (WWEERYT), Winter Wheat Elite Yield Trial (WWEERYT-IR and WWEERYT-SA) - appeared to have high overwintering ability, medium and late earing period (110-125 days from the 1st of January). They are resistant to rust diseases, and lodging, tall and medium height. These varieties are high productive (6-8 t/ha) and more suitable to the Azerbaijan ecological conditions compared with most spring varieties acquired by CIMMYT from Mexico, which have low overwintering ability, early earing period (85-100 days from the 1st of January). They are sensitive to rust diseases (20-90 MS), short, and their seeds drop.

Varieties acquired from CIMMYT are short, earing of these varieties occur early. In spring wheat varieties developmental phases proceed fast, tube formation occurs early during autumn sowing, forced earing under relatively cold conditions prevents normal insemination in the spikelets. However, due to the late earing (the 2nd decade of May) of typical winter samples, grain filling stage that proceeds during severe drought period (spring-summer) becomes shorter, which seriously affects productivity. In spite of some differences observed during many years of experiments, optimum earing period for bread winter wheat varieties introduced to Azerbaijan is considered to be the 3rd decade of April and the 1st decade of May. Because of the absence of severe cold and drought, this period is favorable for the physiological processes proceeding in the plant organism.

The results of the primary tests performed in the Absheron Experimental Base can provide comprehensive characterization of 4 nurseries of Facultative and Winter Wheat Observation (22nd-23rd FAWWON-SA and 22nd -23rd FAWWON-IR) and 4 nurseries of International Winter Wheat Yield Trial (17th-18th IWWYT-SA and 18th-19th IWWYT-IR). Some physiological and agronomical indices of the mentioned nurseries corresponding to the results of the research performed in 2015-2016 are presented in Table 1 a and b.

As seen in the Table in 2015 earing period covered the 1st and 2nd decades of May and in 2016 it covered the 2nd and 3rd decades of April and the 1st decade of May. In IWWIP nurseries the plant height ranged from 93cm to 139 cm in 2015 and from 75 to 130 cm in 2016. Shorter varieties were observed in the 19th IWWYT-IR nursery. Yellow and brown rust did not occur in 2015, but powdery mildew was widespread (from 2 to 9).

Table 1. IWWIP nurseries

Parameters	*22nd FAWWON-IR*	*22nd FAWWON-SA*	*18th IWWYT-IR*	*17th IWWYT-SA*
(a) Absheron 2015				
Cultivation territory	Absheron	Absheron	Absheron	Absheron
Number of samples	116	97	40 (2)	36 (2)
Earing period (from the 1st of January)	121-136 The I and II decades of May	119-141 The I and II decades of May	117-134 The I and II decades of May	119-136 The I and II decades of May
Height (cm)	95-137	112-139	95-131	93-133
Plant disease (powdery mildew)	2-9	3-9	3-9	4-9
Grain yield (g/m2)	360-900	200-800	320- 1050	280-790
Number of chosen samples (Total 69)	31	12	15	11

(b) Absheron 2016

Parameters	*23rd FAWWON-IR*	*23rd FAWWON-SA*	*19th IWWYT-IR*	*18th IWWYT-SA*
Cultivation territory	Absheron	Absheron	Absheron	Absheron
Number of samples	160	100	40 (2)	36 (2)
Earing period (from the 1st of January days)	109-125 The II and III decades of April and the I decade of May	111-126 The II and III decades of April and the I decade of May	109-125 The II and III decades of April and the I decade of May	111-126 The II and III decades of April and the I decade of May
Height (cm)	85-115	80-130	75-110	90-124
Plant disease (powdery mildew, yellow rust)	*P.m.* 1-7 y.r.10-20 S	*P.m.* 2-7 y.r.5-10 S	*P.m.* 2-7 y.r.10-30 S	*P.m.* 2-8 y.r.10-20 S
Grain yield (g/m²)	300-800	250-650	350-700	350-700
Number of chosen samples (Total 38)	13	7	12	6

Table 2. Samples chosen in the IWWIP nurseries.

(a) Absheron 2015

Parameters		*22nd FAWWON-IR*	*22ndFAWWON-SA*	*18th IWWYT-IR*	*17th IWWYT-SA*	*Control Tale-38*
Number of chosen samples		31	12	15	14	-
Earing period (number of days from the 1st of January to earing days)		122-130 The I-II decades of May	122-130	121-130	121-130	129
Height, cm (mean)		110	124	115	122	98
Plant disease	Y.r.	-	-	-	-	-
	B.r	-	-	-	-	-
	P.m	9	8	8	9	8
Grain yield (mean) g/m²		700	670	800	680	524

(b) Absheron 2016

Parameters		*23nd FAWWON-IR*	*23ndFAWWON-SA*	*19th IWWYT-IR*	*18th IWWYT-SA*	*Control Tale-38*
Number of chosen samples		13	7	12	6	-
Earing period (number of days from the 1st of January to earing days)		11-127 The I-II decades of May	115-126 The III decade of April, The I decade of May	111-126 The III decade of April, The I decade of May	110-127 The III decade of April, The I decade of May	119 The III decade of April
Height,cm (mean)		98	110	94	111	96
Plant disease	Y.r.	-	-	-	-	-
	B.r	-	-	-	-	-
	P.m	1-4	2-7	2-6	3-6	7
Grain yield (mean) g/m²		730	628	663	691	553

Note: Y.r. – yellow rust, b.r. – brown rust, P.m. – powdery mildew

In 2016 powdery mildew spread ranged from 1 to 8 and yellow rust occurred (5-30 S) in all nurseries. The samples of the 19th IWWYT-IR nursery were more infected with yellow rust (10-30S). In the IWWIP nurseries grain yield ranged from 200 to 1050 g/m^2 in 2015, and from 250 to 800 g/m^2 in 2016. The number of high productive samples increased. At the end of the vegetation year, 107 perspective varieties were chosen for cultivation the following year in a broader areas.As seen in the Tables, during 2015 and 2016 earing of the samples, chosen in the observation and yield trial nurseries of facultative and winter wheat was early or late compared with the Tale-38 variety taken as a control variant.

But in both cases the optimum earing period ranged from 110 to 130 days. Their height changed between 94 cm and 124 cm and they were resistant to lodging. The chosen samples were not infected with rust diseases, but powdery mildew was widespread among these varieties.

Average grain yield was found to range from

600 to 800 g/m^2 and far exceeded the control variant. The chosen samples were planted in 5 and 10m^2 beds for more comprehensive morphological investigations.

Thus, in 2015-2016, from the IWWIP nurseries 107 perspective, hybrid lines with contrasting productivity, resistance to diseases were chosen for using in the selection process under irrigated and drought conditions. These chosen winter and facultative hybrid lines have high overwintering ability and optimum earing period. They are tall and medium-height, high productive (600-800 g/m^2), resistant to rust diseases and lodging.

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Payızlıq Buğdanın Yaxşılaşdırılması Üçün Beynəlxalq Proqram (IWWIP) Əsasında Tərtib Olunmuş Pitomniklərin Abşeronda İlkin Ekoloji Sınağının Yekunları

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AR KTN Əkinçilik Elmi Tədqiqat İnstitutunun Bitki fiziologiyası və biotexnologiya şöbəsi

Məqalədə qarğıdalı və buğdanın yaxşılaşdırılması üzrə Beynəlxalq mərkəz (CIMMYT) və Quraq ərazilərdə kənd təsərrüfatı tədqiqatları üzrə Beynəlxalq mərkəz (ICARDA) kimi aparıcı Beynəlxalq buğda tədqiqat mərkəzləri və payızlıq buğdanın yaxşılaşdırılması üçün Beynəlxalq Proqram (IWWIP) haqqında məlumat verilmiş, Əkinçilik Elmi Tədqiqat İnstitutu ilə bu mərkəzlər arasındakı elmi əməkdaşlığın məqsəd və nəticələri, həmçinin son iki ildə (2015 və 2016-cı illər) Beynəlxalq pitomniklərdə aparılmış ilkin ekoloji sınağın yekunları barədə danışılmışdır.

Açar sözlər: *Buğda, sort, seleksiya, introduksiya, beynəlxalq pitomniklər, sünbülləmə, dən çıxımı, sarı pas, qonur pas, unlu şeh*

Результаты Первичного Экологического Теста, Проведенного в Питомниках Абшерона по Международной Программе Улучшения Озимой Пшеницы

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В статье представлены данные о ведущих международных исследовательских центрах пшеницы, таких как Международный центр по улучшению кукурузы и пшеницы (CIMMYT), Международный центр сельскохозяйственных исследований в засушливых районах (ICARDA) и Международная программа улучшения озимой пшеницы (IWWIP), цели и результаты научного сотрудничества Научно-исследовательского института земледелия с этими центрами, а также результаты первичных экологических испытаний, проведенных в Международных питомниках в 2015 и 2016 годах.

Ключевые слова: *Пшеница, сорт, селекция, интродукция, международные питомники, колошение, выход зерна, желтая ржавчина, бурая ржавчина, мучнистая роса*